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THE ARGUMENT

FOR THE

ANTIPYRETIC TREATMENT OF FEVER.

BY

LEROY M. YALE, M. D.

[*REPRINTED FROM THE N. Y. MEDICAL JOURNAL, NOV.*, 1874.]

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THE ARGUMENT FOR THE ANTIPYRETIC TREATMENT OF FEVER.[1]

I FEEL as if an apology were due to you for coming before you with such a well-worn theme as the treatment of fevers, especially as much that I have to present is of the most elementary character, and I am not sure that I shall offer any new fact of any importance. But I ask your indulgence because, first, it is always well to systematically review our knowledge of any subject; and, secondly, because at present no subject of medical inquiry is exciting more earnest attention than this of fever in its general sense. The use of the thermometer has brought about a reconsideration of the whole matter, by both physiologists and practitioners. The most striking outcome of their united endeavors is the so-called antipyretic treatment. This plan has already been employed for several years, but not so generally as it should be if the half that is said in its favor be true. Those who have had the largest experience in its use are, almost without dissenting voice, its warmest advocates.

During the past two years I have several times encoun-

[1] Read before the New York Academy of Medicine, October 2, 1873.

tered cases of high fever against which all ordinary treatment proved utterly unavailing. In these extremities I have used, in one form or another, the plan of treatment which we are about to consider. As these cases have been in private practice only, they are still far too few in number to possess any statistical value; yet the hourly watching them has so far convinced me of the efficacy of the method, that I have gladly accepted the invitation of the President—who, in one of these cases, gave me the benefit of his daily counsel—to present its claims to-night. I must, however, first of all disclaim for this paper any especial originality. The field has been worked by such skillful laborers that I shall present a more connected statement by making free use of their results, and uniting with them such confirmatory evidence as I have been able to obtain. Chief of all, I am indebted to the papers of Prof. Liebermeister, who is a master in this branch of investigation.

Of fever, the most striking phenomenon, the most important because probably underlying the others, is the pyrexia, the simple elevation of temperature namely, and it is against this that the antipyretic method is directed.

The antipyretic treatment includes antipyretic measures proper, or those which abstract heat from the body, and antithermic or anticaustic measures, or such as limit the generation of heat, and these will best be considered separately, although ordinarily employed simultaneously.

The chief antipyretic measure in use is the application to the person of water of a temperature below that of the body. This, as every one knows, is no new thing: James Currie, at the close of the last century, vigorously employed it with the happiest results, and his followers vaunted its efficacy in nearly all the specific fevers. In spite of a temporary vogue, after perhaps twenty years, it fell into such total disuse that we to-day might wonder whether Currie and his school were romancers, or we blind followers of fashion who have abandoned one of the most reliable resources of our art. But, if, as is doubtless the truth, the neglect of water-treatment is the fault neither of exaggeration nor stupidity, but of the purely empirical basis on which it rested, without science to guide its application or to secure its perpetuity, it will, I am sure, be time

well spent to make a digression for a mention of the theoretical grounds of its use, the laws, namely, of the production and regulation of heat within the human body. Regarding many points physiologists are still at variance, and I shall endeavor to avoid such as are in dispute.

Long before the subject of animal heat had been investigated with the accurate methods of modern physiology, the fact was known that the human body not only had a temperature above that of its surroundings under ordinary circumstances, but that in health the temperature taken in the cavities of the body was essentially invariable, being unaffected, or nearly so, by any change of temperature in the surrounding atmosphere, or variation in the relations of the person. This fixed temperature is 37° C., or 98.6° Fahr.

The loss of heat from the human body, moreover, is one of the most familiar of facts. This loss is accomplished by radiation, by perspiration, and evaporation, by the expiration of heated air, and in similar ways. The loss is not fixed in amount, but is diminished or increased by the rise or fall of the temperature of the surrounding atmosphere, and is likewise increased by a profuse perspiration, or by an exaggeration of any of the ordinary methods of loss. Nevertheless, under ordinary circumstances, the loss is tolerably uniform, and its amount has been ascertained to be sufficient, if retained within the body, to raise the temperature of the body 1° C. (1.8° Fahr.) every half-hour, or to warm a body of water five-sixths of the weight of the person the same amount in the same time. That is, if the heat each one of us gives off in twenty-four hours could consistently with life be retained within his body, its temperature at the end of that time would have risen 48° C., or 86.4° Fahr., and would have reached 185° Fahr., a temperature above the point of coagulation of albumen, and high enough to cook the tissues. This loss is made good by the production of heat within the tissues; and, as the loss is subject to great increase at times, the production must be in some way accurately adjusted to the loss, in order that the body should preserve its uniform temperature of 98.6° Fahr. The production is due to chemical changes, to oxidation, namely, within the tissues, and it may be increased by

those agencies which augment oxidation; for instance, by the ingestion of food, particularly such as is readily oxidizable, or by muscular exertion, which alone may many times increase the ordinary production. Now, it is evident that the relation of loss and production must in some way be regulated, otherwise a day's work, even of the short duration now legal, would leave the laborer with a terrible fever temperature, or a few hours' exposure to cold would chill him below the limits of safety.

There are two general ways in which this correspondence is preserved; by the limitation of the loss, and by the accommodation of the production to the loss. The loss is limited automatically by the effect of cold upon the skin. When the skin is chilled there is an immediate contraction of the capillaries, the amount of blood circulating superficially is much diminished, and, as the body as a mass must cool very slowly, and the warm blood is in great part kept from the surface, the abstraction of heat is greatly diminished, and the heat-producing function is relieved as far as possible from excessive strain. Conversely, when the surrounding atmosphere is warm, the capillaries are dilated, the superficial circulation abundant, radiation rapid, the sweat-glands are stimulated to action, and the evaporation of moisture from the surface effectually aids the loss of heat. Instinct and intelligence lead animals and man to limit or increase at will the loss of heat by choice of place of abode, by their coverings, and in the case of man by many artificial contrivances.

Still further the amount of heat produced is directly dependent upon the amount lost. Under ordinary circumstances this is not very apparent, except as inferred by the greater inclination to muscular exertion, and by the greater desire for food in cold weather to supply the waste, and in very cold weather the unusual appetite for easily-oxidizable articles, such as fatty substances. But by means of physiological experiments, the increased production can be demonstrated and its amount measured. The most convenient method is by immersion of the body in a bath of a temperature below that of the body. Let us take a simple example, dismissing the corrections to be made. We have seen that the heat normally

lost by a man weighing one hundred and fifty pounds would in half an hour raise one hundred and twenty-five pounds of water 1° C., or two hundred and fifty pounds .5° C. or .9° Fahr. If, however, at the end of the time we find the two hundred and fifty pounds raised 3° C., we must conclude that the body has lost six times its normal amount; and if, in the mean time, the body preserves its normal temperature, it is evident that there has been an equivalent production. Now, in fact, it has been found that, after proper corrections have been made for heat acquired from the air, loss by evaporation, superficial cooling of the body, etc., the loss is:

In a bath of		20° C.=	68° Fahr.,	6½	times	the	normal.
"	"	22.5° C.=	72° "	4½	"	"	
"	"	25° C.=	77° "	3+	"	"	
"	"	28° to 30° C.=	82.4° to 80° "	2+	"	"	
"	"	34° to 35° C.=	93.2° to 95° "	about the normal.			

From which it appears that the production of heat increases with the abstraction.

The question remains, by what means is this correspondence between loss and production effected? As far as we now know, it must be through the nervous system, as all other proposed explanations are totally inadequate. But, on the part of the nervous system, both a heat-inhibitory centre and an excito-caloric centre (the latter acting in a reflex manner under stimulation from the skin) have been assumed. Facts and experiments have been forthcoming to support both theories, but those on which the hypothesis of an inhibitory centre rested have been recently discredited.[1] If it be a fact, as alleged, that cold water injected into the rectum abstracts heat without exciting production, it would certainly lend weight to the assumption of an excito-caloric centre dependent upon reflex excitation from the skin.

Like all other functions, that of heat-production has its limits of activity. For a short time the production may be enormously stimulated, but, when the limit is reached, there is either a depression of body temperature, as when the loss is too severe or prolonged, or, if, by too great artificial heat or

[1] *See* Dr. Burdon Sanderson's address to the British Medical Association, 1873.

excessive muscular exertion, the accumulation is very great, a condition of fever is assumed, or exhaustion follows.

Thus far the conditions obtaining in health. Whenever the state denominated fever exists, the most striking, and we believe the most essential, change from the condition of health is the rise in temperature. This is not due simply to increased production (generally twenty to twenty-five per cent.), for this is often exceeded in health as the result of excessive muscular exertion. Nor is it due to storage of heat, for there is the equilibrium of production and loss, just as in health, with this essential difference, that, instead of 98.6° Fahr., some other and higher point is the standard of regulation. With this change, the production and regulation of heat are under the same laws as before; but the body is now less tolerant of prolonged or severe abstraction of heat than it is in health, probably because the raising of the regulation-point has by so much exhausted the producing power held in reserve. It is upon this peculiarity in great measure that the success of the antipyretic method depends; the abstraction of heat still excites greater production, but the limit is more speedily reached, and a positive fall results at once or soon after, as if by reaction.

This change of the regulation-point explains readily the phenomena of fever. If the change is gradually made, there is a gradual increase of production, and generally a dry skin limits the loss until equilibrium is reached. If, however, the change occurs suddenly, the body is placed in the same relative condition as it would have been if there had been such a large and sudden abstraction of heat (as, for instance, by immersion in iced water) as to bring the heat of the body below the regulation-point. Every effort is made by the economy to bring the temperature of the body up to the new point. The conservative phenomena of a chill are at once presented; we have already seen how the capillary contraction and resulting superficial anæmia limit the loss of heat, and how the shivering is an involuntary muscular effort for still greater production. In addition, greater oxidation is going on, and during the chill the elimination of carbonic acid may be doubled or trebled. The severity of the chill is proportioned rather to the rapidity than to the degree of the change in the regula-

tion-point. The chill or chilliness will continue until the temperature of the body reaches its new regulation, and it is now apparent why, if this point be, say, 105° Fahr., the patient still suffers from cold, when his temperature is 103° Fahr., and why, before full equilibrium is established, he is often abnormally sensitive to slight draughts of air and the like. When at length the regulation is effected, the equilibrium will be maintained with its daily fluctuations until the regulation-point is again changed; if to a higher one, then the symptoms of the first rise will be repeated in a greater or less degree; if to a lower point, if the change be slow, the fall of the fever will be gradual; if rapid, the body is suddenly placed in a condition of superheating. The excessive production ceases, every avenue for the escape of heat is opened, clothing is not tolerated, profuse perspiration breaks out, and persists till the stored-up heat that preserved the abnormally high temperature has been given off, and the body reaches the temperature of the new regulation-point (or even temporarily a little below, if we take skin temperature). Most of you have seen the axillary temperature in the first forty-eight hours of defervescence of pneumonia sink to 96° Fahr. or thereabouts.

Examples of these various methods of change will present themselves directly to you all. For instance, the severe chill, short equilibrium, and sudden defervescence, are seen in our typical intermittents; the sharp onset, prolonged equilibrium, and speedy fall in pneumonia, of ordinary course; the slow access, long equilibrium, and gradual fall, in typhoid fever. Many peculiar modifications of these points are seen in other diseases, notably in remittent fevers, catarrhal inflammations, and the like.

It every day becomes more and more certain that the great majority of persons, dying of diseases attended with acute pyrexia, die because of the high temperature and changes wrought by it upon the tissues, rather than from the exhaustion caused by the destruction of tissue by oxidation and over-production of heat. If the temperature of an animal is artificially raised 9° or 10° Fahr., the animal will die. Clinical experience shows us that the human body can endure but for a very short time a like elevation of temperature. The tolerance is greater

for a lower degree of pyrexia, and where the elevation is very slight it may be endured until the consumption rather than the change of tissue may be the cause of death. But, as has just been said, in high fever the danger is mainly from this effect of the elevated temperature upon the integrity of the tissues, and most of all upon the circulatory and nervous systems, as manifested in cardiac or cerebral palsy. There is no need to call to your attention the evidence of failure of the heart's power in the changes of the pulse, the local congestions; nor of the progressive disturbances in the functions of the encephalon, the delirium, the interferences with coördination, and finally the damage to the medulla, that rapidly proves fatal. Long before any material wasting occurs, there are in both heart and brain actual tissue-changes taking place which may destroy life, or which may persist long after convalescence has been established.

If, then, such damage is the direct result of keeping the tissues at a temperature incompatible with their integrity, the prime indication of treatment is to lower this temperature to within safe limits by the use of the antipyretic and antithermic means at our command. Even if the depression is but temporary, it will be of great value by interrupting the morbid process; fever being, as a rule, dangerous in proportion to its continuity, clinical proof of which may be drawn from the far less fatality of periodical fever, however prolonged, where the high temperature is interrupted, as compared with that of fever of a more continued type.

The great antipyretic measure is, as already said, the application to the person of water of a temperature more or less below that of the body. The particular method in which this is done may vary greatly. The general bath, the cold douche, the pack, washings or spongings, are all employed, besides local abstractions of heat, as by ice-bags, cool drinks, and rectal injections.

In the foreign hospitals, from which our statistics are mainly gathered, the *general bath* has been the method chosen, and where it can be employed is doubtless the most effectual. The temperature for patients of ordinary vigor is about 70° Fahr. Baths much colder may in emergencies be used, but

70° is cold enough for cases where the fever is likely to continue. The time that the patient is immersed will average ten minutes; five to seven minutes will be sufficient for many persons. While the patient is in the bath his bed should be arranged with warm, dry wrappings, and with a foot-warmer of some sort. The patient is removed without delay, for drying, to these wrappings, and rolled warmly up, and left quite undisturbed. Most patients will be the better for a glass of wine or spirits-and-water, to prevent cardiac depression. Although the cold bath of this short duration is more effectual than a longer warmer one, there are patients whom we may hesitate to treat with so great rigor, and for whom a bath of 75° Fahr., or even higher, will be more prudent. Ziemssen has suggested the use of warm or hot baths, say of about 95° Fahr., gradually cooled to 75° Fahr. or lower. In diseases having a course at all prolonged, and where it is desirable to make a decided and at the same time quite continued depression of temperature, the bath is the best form of water-treatment. In private practice, however, it can rarely be effectually employed unless the sick-room and bath-room are adjoining, and for my own part my experience of the full bath is confined to the eruptive fevers in children, who can be easily carried from room to room.

The next most efficient method is, I believe, the *pack*. It has the advantages of being well borne by even very feeble patients, and of being applicable under nearly all circumstances. It has not the power of the bath. I have, however, I think, obtained considerable power by giving it in the following manner: Upon the floor or upon a cot-bed placed near the sick-bed, a large rubber sheet is placed, and upon it several thicknesses of sheets dipped in water of the proper temperature. The sheets should be folded in such a way as to be large enough to envelop the trunk and thighs of the patient. As the duration of the pack may be long continued, it is well that the extremities, particularly the lower, should not be included, in order that chilling may be avoided. Upon these wrappings the patient is placed, and the sheets folded over the person. The edge of the rubber sheet should then be turned up to retain the water, and with a large carriage-sponge the cloths

kept constantly drenched with fresh water from a pail, and the overflow as rapidly removed to another vessel. One who has not witnessed this application of water will scarcely believe how rapidly it is heated. But by the constant renewal of the water, a powerful irrigation is established that approximates the bath in efficiency, and is free from the peculiar disadvantage of the douche. The temperature of the water to be used depends upon the same considerations as when the bath is employed.

The *douche* is far more valuable for excitation of respiration than for abstraction of heat. It does certainly depress the temperature, but its great use is in cases where, as in sudden hyperpyrexia, cyanosis and evidence of passive pulmonary congestion are present.

Sponging with cold or even iced water has a very considerable power in lowering the temperature if persisted in for some time. It is, I believe, most applicable in cases of acute pyrexia of naturally short duration, in which the defervescence, if once accomplished, is generally more or less lasting, or to cases, like those of surgical fever, which I shall quote, where the nature of the injury or operation, or the surgical dressing, forbids the bath or pack. The efficacy of *hot sponging* depends chiefly or solely upon evaporation from the surface.

Local applications have only a local effect, and are useful to combat local symptoms, such as cerebral congestion. A peculiarity attributed to rectal injections—that, namely, they simply abstract heat without stimulating production—has been mentioned. But it is evident that such an application could not be long continued, without doing damage greater than its benefit. It may be used as an adjuvant to other methods. The ingestion of cool drinks has advantages and disadvantages similar to those of rectal injections.

The abstraction of heat by water is sometimes insufficient to make an intermission or remission of the fever; under such circumstances the object may generally be obtained by the additional use of certain drugs, notably quinine, digitalis, veratrum, and aconite.

In using quinine to depress the temperature, it must be given in very large doses. I am not referring at all to its so-

called specific action in combating malarial fever, nor to its use in fever of probable septic origin, where its antiseptic power may be called into play, but to its use in causing a remission in a fever otherwise continuous or nearly so. For this purpose the dose must be very great, that recommended by German writers varying, according to circumstances, from fifteen to forty grains. They claim that such doses are always followed by some remission of fever, generally by a marked one, i. e., to below 100° Fahr., but that to accomplish this the full dose of quinine must be taken at once, or if divided the portions must be separated by very short intervals, just sufficient to prevent rejection by the stomach, say of fifteen minutes. If the depression be thus obtained, the medicine need not be repeated sooner than forty-eight hours, and the dose may then be somewhat smaller in size.

I have carefully watched many cases and have never been able to see any considerable depression that I could certainly attribute to the medicine if the quinine were given in divided and separate doses, even if twenty-five or thirty grains were taken in a day, excepting always cases in which a malarial element was present, which I freely admit is very likely to be the case in this region. I think the nervous disturbance produced by the drug in some patients, particularly women, more than compensates for the value of the quinine, if we exceed ordinary tonic doses, unless we give enough to decidedly depress the heat and thus relieve in one way more than we distress in another. If the stomach does not tolerate the dose, the rectum or the subcutaneous tissue will, if the urgency of the case demand it at all.

With digitalis and veratrum I have so little experience in this connection that I am obliged to give a quotation from Liebermeister:

"In severe febrile diseases in general, the more excessive is the frequency of the pulse, the less is digitalis indicated; it seems, when heart-palsy is impending, to hasten its appearance under certain circumstances.

"It may, on the contrary, be given in typhoid fever with benefit, so long as the heart's action is not excessively frequent, or at least while it has still considerable power. In especially severe and obstinate cases, where a sufficient depression of

temperature cannot be obtained by quinine alone, the desired effect may generally be obtained by a combination of digitalis and quinine. From three-quarters of a gramme to a gramme and a half (say eleven to twenty-two grains) of digitalis in substance is gradually given in the course of twenty-four or thirty-six hours, and immediately afterward a full dose of quinine (2 to 2½ grammes = 30 to 38 grains). If this brings about a perfect intermission, quinine alone generally ceases its repetition.

"Veratrine is a very reliable antipyretic, if it be given in sufficiently large doses; it often brings about a perfect intermission in cases in which it cannot be obtained by means of quinine. I usually give pills containing five milligrammes (about one-thirteenth of a grain) of veratrine each, one hourly until severe nausea or vomiting occurs. Four to six pills generally suffice. The collapse which easily follows the vomiting, where the temperature rapidly falls, is not dangerous in typhus cases, and is ordinarily speedily removed by wine or other analeptics."

Whether in the midst of a typhoid fever this interference with the stomach is judicious, would seem to me to be open to question.

From the use of aconite I think I have also seen decided lowering of the temperature, but as it has generally been employed in conjunction with other remedies, and in fevers of short duration, I am in doubt just how much is due to each, and how much to the natural fever-curve.

I have thus presented the method known as the antipyretic. It remains to be said, regarding the bath, that it is to be given as often as required to keep down the temperature below a given point, for unless we overcome the production of heat we are simply stimulating consumption; many baths daily may be necessary. Liebermeister mentions a case in which, during the illness, about two hundred baths were administered. I have myself given in a week to a single patient thirty-five of the irrigated packs already described, varying in duration from ten to thirty minutes each. In another case I have kept the cloths wet with tepid water for twelve hours consecutively. Nor should any *a priori* dread deter the physician from the plan; he should be guided by the actual results, and must

adapt the degree and details of treatment to each case and its varying condition. And here lies the greatest difficulty of the whole matter—cold and full doses of our most active drugs are agencies powerful for good or evil; and, that they should be uniformly potent for good, demands constant intelligent attention from a medical man. In the city it can be carried on often by advanced students who are generally quite willing to perform the arduous duty for the experience thus gained. That it is taxing is true enough, but is the labor greater than is often necessary to save a case of peritonitis or to successfully carry through many surgical operations?

But the great question still is, Is the benefit of the treatment at all commensurate with its labor? And to answer this question I shall briefly give some statistics that I have made note of during the last three years:

1. *Typhus and Typhoid Fevers.*—The earliest I have met are those of the Kiel Hospital, where, under ordinary treatment, during the eleven years 1850 to 1861, there were 330 cases, 51 deaths = 15.4 per cent. In the same hospital from 1863 to 1866, there were treated with cold water, 160 cases, 5 deaths = 3.1 per cent.

Liebermeister's statistics of the hospital at Basle:

I. *Ordinary Expectant Treatment*, with (toward the end of the time) an occasional bath:

Date.	Cases.	Deaths.	Per cent.
1843 to 1853	444	135	30.4
1854 to 1859	643	172	26.7
1860 to 1864	631	162	25.7
	1,718	469	27.3

II. *Imperfect Antipyretic Treatment*, i. e., the use of perhaps one bath daily, rarely two, and a moderate use of quinine and digitalis: January, 1865, to September, 1866, 982 cases, 159 deaths = 16.2 per cent.

III. *Active Antipyretic Treatment:*

Date.	Cases.	Deaths.	Per cent.
Sept., 1866 to end of 1867	339	33	9.7
1868	181	11	6.1
1869	186	10	5.4
1870	139	10	7.2
	845	64	7.6

Liebermeister makes allowance for the difference in diagnosis in the two periods, and still thinks the mortality not above a third of that formerly existing.

Binz (*Lancet*, February 4, 1871) gives the result of his trial at the Army Hospital, near Compiègne, in the campaign of 1870–'71, where he had, up to the time of report, treated one hundred and ninety cases of typhoid fever, one hundred and thirty of mild type, and sixty of grave. The mild cases he throws out of consideration altogether. The statistics are of the sixty grave cases only. The treatment was the bath of about 77° Fahr., and wine on leaving it, and every second day fifteen to twenty-two grains (1 gramme to 1½) of quinine. Of these sixty cases, one died from peritonitis, two from intestinal hæmorrhage, and a fourth he counts as fatal from diarrhœa, although still living at the time of report. This gives a mortality of 6.6 per cent.

The Dresden hospital for fever patients had, in 1870, a death-rate of 4 per cent. (*Lancet*, December 31, 1870) for two hundred cases treated in this way.

I had hoped to give you some statistics from our own fever hospital, where this plan was tried several years ago with asserted success. But no record can now be found.

In the *eruptive fevers* the benefits of the water-treatment are said to be not less than in the typh-fevers. I have noted many favorable comments upon its use, but have met with no statistics. From my own observations I am able, however, to testify to the relief of suffering from the use of the tepid bath.

Two of my medical friends have related to me cases of *puerperal fever* in which the pack in the one case and sponging in the other greatly mitigated the suffering, and in their belief prolonged life, although a fatal result was not prevented.

The result in *pneumonia*, of a type grave enough to demand any such treatment, is certainly relief, and Liebermeister asserts that, in two hundred severe cases in which he has used this treatment, he has materially diminished the mortality.

In cases of *hyperpyrexia*, sometimes occurring in *acute articular rheumatism*, and which ordinarily are dangerous in the extreme, it has been much praised, particularly by the

German writers, although not by them alone. Cases of the use of the bath 86° to 90° Fahr., and of the cold pack in this condition, may be found in the *Practitioner*, numbers for July, 1872, and February, 1873.

During the summers of 1872 and 1873, the antipyretic plan was employed at Bellevue Hospital to subdue the intense fever in cases of *sunstroke*. The most common method resorted to was the sponging, although the pack, douche, and enema, were likewise used. Digitalis and aconite were added in the more rebellious cases. One case reported by Dr. Katzenbach (New York Medical Journal) showed the extraordinary temperature of 110½° Fahr. The application of the wet sheet, kept wet by sprinkling, reduced the temperature to 104¾° Fahr. in the course of two and a half hours. The pulse and respiration at first rose and then fell. The chest was cupped to relieve cyanosis, and after half an hour the pack renewed; half an hour later the temperature was 102° Fahr., a fall of 8½° Fahr. in three hours and a half. Cold sponging was then substituted, and later hypodermic injections of tinct. digitalis added, reducing the temperature still further. The patient recovered.

Dr. Perry, House-physician at Bellevue Hospital, has been investigating this subject, and has very generously placed his case-book at my disposal, and has given me the following abstract of the results in the hospital:

"Our method of employing antipyretic treatment in insolation has been to strip the patient, lay him on the floor, or upon a bed upon which a rubber cloth has been placed, and then to rub the body with ice or with a large sponge wet with ice-water, until the temperature falls several degrees, as shown by the axillary thermometer. Frequently the water is poured from a pitcher from a height of two or three feet or more, but in such cases the object is to arouse the patient or give him a shock, rather than to reduce the temperature. The fall in temperature under this treatment is very sudden.

"In one case of insolation admitted comatose, with puffing respiration, tracheal *râles*, and a temperature of 106¼° Fahr., the temperature fell in fifteen minutes to 101¾° Fahr., and the pulse from 160 to 120. This reduction was maintained for half an hour after the application of water was discontinued.

"Fanning continuously has been often used to hasten the evaporation of the water, and is considered a valuable adjunct in reducing temperature, but is not indispensable. When, however, the temperature has been reduced by water, constant fanning will materially assist in maintaining the reduced temperature. The treatment has been followed when the patient has been lying on the floor with the windows and doors of the ward open, and the strongest current of air allowed to pass over him without any subsequent ill-effects.

"Again, hot water has been employed to reduce the temperature still further, when, during the application of cold water, the temperature remains at nearly the same point for some minutes. There is no doubt that the temperature may be reduced to almost any point if the ice-water is vigorously applied. But, by the application of hot water, it is thought that the evaporation is much hastened, and consequently a greater reduction is obtained upon the temperature. In the case above quoted, the temperature was reduced from 101¾° Fahr., the point obtained by cold water, to 99° Fahr., and the pulse was noticed to increase in fullness, and to fall from 116 to 96."

From Dr. Perry's case-book examples might be multiplied to illustrate the different forms in which water was used, and the use of digitalis and aconite, but I have already extended this paper far beyond my intent. I am unable to state the precise change in the death-rate of cases of sunstroke since the use of the antipyretic system, as I have no statistics of what it formerly was, but I am verbally assured that it has decreased. I am certain that cases with excessively high temperature are now saved that were almost uniformly fatal within my own recollection of hospital cases. The time requisite to reduce the temperature varies considerably; but, if the temperature be 106° Fahr. or more, a fall of about five degrees may be expected within an hour and a half to two hours, at least it so appears for the cases recorded by Dr. Perry.

Dr. Burchard, one of the house-surgeons of Bellevue Hospital, informs me he has treated a large number of cases of surgical fever by water with very gratifying results. He has given an abstract of several illustrative cases, with the following comment:

"By experience I have learned that cold water, ice-water if you please, reduces the pulse and temperature more rapidly than either hot or tepid, but the shock is to be deprecated in feeble cases, and the reaction is more speedy and greater. Hot water answers next best, but sometimes will not reduce the temperature. I think the after-feeling of hot sponging more agreeable to patients than cold. Tepid water is perhaps pleasanter to the patient than either hot or cold, but its effects are not so decided or permanent. I often employ ice-water for a couple of hours, then tepid, or frequently a mixture of equal parts of alcohol and ice-water; this answers admirably in surgical fever."

Besides the depression of temperature, and the slowing of the pulse—which latter, in my experience, is not so uniform or quite so speedy a result—I am sure the water-treatment diminishes the irritability of the nervous system, which is certainly of great importance, especially in those cases where this irritability is the chief, if not the only appreciable, cause for the continuance of the high temperature.

It is, lastly, not a small consideration that by this management cleanliness is easily maintained, and the tendency to bed-sores diminished.

In the foregoing remarks I have endeavored to make evident the following propositions:

I. That there is an exact regulation of the heat of the human body in health, the production corresponding to the loss, but that excessive abstraction of heat may overcome the power of production.

II. That the same laws govern the high temperature of fever, with the exception that the producing power is more speedily exhausted.

III. That the danger in acute pyrexia is due not so much to consumption of tissue and consequent exhaustion, as to tissue-changes incompatible with life, caused by the elevation of temperature, and that this danger is proportional to the height and continuity of the fever.

IV. That the indication is to abstract heat and limit its production in all cases in which the temperature is so high as to make the danger from it greater than that from exhaustion.

V. That in the use of cold water we possess an agent adequate to overcome the heat-producing power.

VI. That we possess certain drugs that have the power of interrupting the excessive heat-production.

VII. That the statistics of the antipyretic method are exceedingly favorable, when compared with those of any other plan of treatment, for all forms of acute pyrexia, whether with reference to diminished death-rate or to mitigated suffering.

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